

Docket No.12902-4

PATENT APPLICATION

LIGHT EMITTING DEVICE AND METHOD OF USING SAME

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Title: Light Emitting Device and Method of Using Same
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BACKGROUND OF THE INVENTION

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The present invention generally relates to light emitting devices and more specifically to devices and methods which allow a person to illuminate an area without revealing the person's location.

There times when it is desirable to illuminate a darkened area without revealing a person's location. For example, law enforcement officers may wish to ascertain whether someone is within a darkened area. Conventionally, law enforcement officers would shine a flashlight into the darkened area. However, shining a flashlight immediately betrays the officer's position, making the officer a potential target. Other means of illuminating a darkened area would be to deploy a flare or other light emitting device into the area. However, once again, when the officer deploys such a device into the area, his position is revealed. The present invention addresses this need.

SUMMARY OF THE INVENTION

The present invention is directed to a light emitting device which is deployed into a darkened area to illuminate the area with either visible light or, optionally, with infrared light. While not limited to such use, the present invention may be used by law enforcement to illuminate an area without law enforcement officials having to reveal their position, which is the case if flashlights are used. If infrared lighting means are used, appropriate infrared detection equipment must be used.

The light emitting device comprises a substantially transparent and generally spherical housing. A circuit is contained within the housing, where the circuit is connected to the light emitting means. The circuit comprises light emitting means, a time delay means, which delays the energizing of the light emitting means, and battery means for providing current to the light emitting means. The circuit further comprises a switch which, upon activation, closes the circuit providing current from the battery.

Also disclosed is a method of utilizing the present invention to strategically illuminate a darkened area.

BRIEF DESCRIPTION OF THE DRAWINGS

- FIG.1 is a perspective view of a first embodiment of the disclosed invention.
FIG.2 is a front view of a first embodiment of the disclosed invention.
FIG.3 is a back view of a first embodiment of the disclosed invention.
5 FIG.4 is top view of a first embodiment of the disclosed invention.
FIG.5 is bottom view of a first embodiment of the disclosed invention.
FIG.6 is a perspective view of a second embodiment of the disclosed invention.
FIG.7 is a sectional view of the second embodiment.
FIG.8 is a detailed view of a switch assembly for an embodiment of the invention.
10 FIG.9 is a detailed view of a switch assembly for an embodiment of the invention.
FIG.10 is a circuit diagram for an embodiment of the invention.
FIG.11 is a flow chart showing the logic for an embodiment of the invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

15 Referring now specifically to the drawings, Figure 1 shows a front view of a first embodiment of the disclosed device 10. This embodiment 10 comprises a substantially transparent housing 12 which may be constructed of high impact plastic or other transparent materials such as plexiglass or high strength glass. As shown in Figures 1 through 3, the housing 12 may be generally spherical. A light emitting means, such as one or more light emitting diodes 20 14, are part of a circuit contained within the housing 12. The light emitting diodes 14 may be of such a color, such as red or green, as to preserve the night vision of the users. Alternatively, the light emitting diodes 14 may emit light within the infrared spectrum. Acceptable infrared diodes are available through AGILENT, such as the model HSDL 4420 infrared emitter. With this embodiment, the only persons capable of seeing the illumination would be those equipped with 25 infrared vision devices, such as infrared goggles. In the event the device is used to illuminate an area in which a criminal suspect may be located, the use of infrared diodes would prevent the suspect, not equipped with an infrared vision device, from knowing that he or she has been illuminated.

A circuit 16, such as that depicted in Figure 10, is contained within the housing 12. The 30 circuit comprises the light emitting diodes 14 and time delay means which delays the energizing of the light emitting diodes. The circuit 16 may comprise an integrated circuit, such as

microcontroller 20 having a timer. The microcontroller 20 may be packaged as a thin shrink small outline package (TSSOP). The TSSOP may comprise a plurality of leads 22, such as the sixteen leads depicted in Figure 10. The circuit may also comprise a voltage regulator 23. The microcontroller 20 may be in the Motorola 908Q family. An acceptable microcontroller 20 is a 5 Motorola model MC68HC908QY4CDT having in-circuit re-programmable flash memory. This feature allows the time delay to be readjusted as desired such that the light emitting means, such as the light emitting diodes 14, are energized at a specified time. For example, the time delay might be set at a value of five seconds. However, because of the programmable nature of the microcontroller 20, the time delay may be set at almost any desired value. As shown in Figure 8, 10 test point numbers 1 through 8 (designated TP1 through TP8) are utilized as communication links between the microcontroller and a programming device, such as a computer, to download or upload a particular program to or from microcontroller 20. As shown in Figure 8, the circuit further comprises a plurality of resistors.

The light emitting diodes 14 may be divided into a first set of light emitting diodes and a 15 second set of light emitting diodes. For example, the light emitting diodes 14 visible in Figure 2 may comprise the first set and the light emitting diodes 14 visible in Figure 3 may comprise the second set. The microcontroller 20 may then be configured so that the first set of light emitting diodes 14 and the second set of light emitting diodes are not energized at the same time, thereby reducing the current drawn by the circuit 16. The frequency of energizing the light emitting 20 diodes 14 may be programmed into microcontroller 20. For example, the first set of light emitting diodes and the second set of light emitting diodes are alternatively energized at 150 cycles per second. At this frequency, it appears that all of the light emitting diodes remain energized, i.e., the blinking of the diodes is not perceptible by the human eye. It is to be appreciated that the frequency of energizing different diodes 14 and the duration of the energized 25 state may be programmed into the microcontroller, resulting in a large number of available combinations. For example, the diodes may be programmed to emit an S-O-S distress call, making the device useful to backpackers, boaters, or others who may be caught in the elements.

The circuit 16 also comprises a battery means, such as battery 24. Battery 24 is also enclosed within housing 12. The battery 24 may be of the nine volt variety, having a positive 30 and negative terminal on the same end. A snap-on connector 25 is connected to the terminals, the lead wires from the connector conductively connected to the other components of circuit 16.

The circuit 16 further comprises a switching means, such as microswitch 26, which, upon activation, closes the circuit between the battery 24 and the microcontroller 20, providing current to the various circuit components, such as the microcontroller and light emitting diodes 14. The apparatus may also comprise a switch extension 28 configured to engage microswitch 26. The 5 switch extension 28 may comprise a button 30 and a shaft 32. Because it may be desirable that the device operates silently, the underside of button 30 may comprise insulating member 34, which prevents any clicking caused by the button 30 engaging the housing 12. The exterior of housing 12 may also comprise a recessed section 36, such that a portion of the switch extension 28 extends into the recessed section, allowing the user to engage button 30. Switch extension 28 10 may be configured such that there is friction fit between shaft 32 and the surrounding housing 12 so that once button 30 is pushed downwardly, thereby activating microswitch 26 and closing circuit 16 until button 30 is pulled upwardly to deactivate the microswitch and open the circuit.

The present device may be deployed by propelling it into a dark environment. If the device is rolled or thrown by the user, the resulting impact or vibration may cause the 15 microswitch 26 to switch to the "off" position. Therefore, one embodiment of the present device includes means for causing switch extension 28 to be retained in a positively locked down position after being depressed in order to maintain the microswitch 26 in an "on" position. The device may be deactivated by pulling upwardly on the switch extension 28.

Figures 8-9 shows one means of maintaining the switch extension in a locked position. 20 In this embodiment, a spring 37 may be used to apply a lateral force to shaft 32, which biases a contoured segment 38 of shaft 32 to a matching profile 40 of housing 12, providing a detent to hold the switch extension 28 in a downward position. Spring 37 may be held in position by spring retainer 42, which may be molded on the inside of housing 12.

As shown in Figure 4, housing 12 may comprise a first hemisphere 42 and a second 25 hemisphere 44 attached together with fastening means 46. As shown in Figure 5, the fastening means may be inserted into access ports 47 to maintain the generally spherical configuration of the housing 12. In this configuration, a circuit board 48 may be set between the first hemisphere 42 and the second hemisphere 44. In the first embodiment 10, the first hemisphere 42 and the second hemisphere 44 may be mirror images of another, thereby simplifying the 30 manufacturing process. The circuit board 48 may be configured to contain the circuit 16. In order to change out battery 24, fastening means 46 are released and the two hemispheres

separated allowing access to the battery. The circuit board 48 may have a rectangular opening in the approximate mid-section of the circuit board. A battery storage compartment 50 may extend through the rectangular opening in the circuit board 48. A nine volt battery 24 may be disposed within the battery storage compartment 50.

5 A second embodiment 100 of the disclosed device is shown in Figure 6. This embodiment comprises a generally spherical housing 12' having a flat base 102. The base 102 is attached to the housing 12' with fastening means 104. As shown in Figure 7, access to battery 24 may be gained by removing base 102, allowing the battery to be changed without taking the housing apart as required by the first embodiment 10. Base 102 may comprise a weighted
10 material, such as iron or lead, which is heavier than the plastic generally used for the rest of the housing 12'. The use of weighted material in the base 102 provides a self-righting means which causes the device, following deployment on a surface, to come to a resting position with the flat base 102 engaging the surface. This feature increases the probability that the light emitting diodes 14 will be oriented as desired when the device comes to a resting position.

15 Figure 11 is a flow diagram showing one variation of how the microcontroller 20 may be programmed for the device. In this program, the light emitting diodes 14 are set into a first set and a second set, with each set energized at a frequency of 150 hertz. This program also checks the battery voltage. If the battery voltage is less than 7 volts dc, the light emitting diodes flash once for 0.5 seconds to indicate that the battery voltage is low.

20 While the above is a description of various embodiments of the present invention, further modifications may be employed without departing from the spirit and scope of the present invention. For example, the size, shape, and/or material of the various components may be changed as desired. Thus the scope of the invention should not be limited by the specific structures disclosed. Instead the true scope of the invention should be determined by the
25 following claims.